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Patent Application

of

HERBERT BALTES
and
GERNOT RUPP

for

HYDRO DAMPER

Field of the Invention

The present invention relates to a hydro damper for attenuation of pressure oscillations and/or acoustic oscillations in systems which can use pressurized fluids for their operation.

Background of the Invention

In hydraulic systems, equipment-induced processes of varied types can cause pressure fluctuations, for example, due to the sudden connection of spaces with different pressure levels, due to actuation of cutoff and control fittings with short opening and closing times, especially due to nonuniformities in the operation of positive-displacement pumps, in which pump pulsations arise, and due to processes of turning positive-displacement pumps on and off.

Damper arrangements of varied designed are used to attenuate pressure fluctuations, periodic pressure oscillations or the resulting acoustic oscillations. Hydraulic dampers can be based on the principle of hydropneumatic bladder-type and diaphragm accumulators, or can be made as reflection dampers (silencers).

The general prerequisite for the effectiveness of hydraulic dampers is that the damper housing encompasses a relatively large volume. This relatively large volume in turn leads to correspondingly large dimensions of the damper housing. In hydraulic systems for installations in which only a limited installation space is available in the machinery room containing the hydraulic pump, a hydraulic damper must be connected to the system output, which damper attenuates the pressure oscillations and acoustic oscillations of the pump pulsation. Problems frequently arise due to the space requirement of the hydraulic damper to be accommodated with a relatively high-volume damper housing. This problem arises to an increased degree in conjunction with hydraulic systems of injection molding systems, where good damper action at the output of the pertinent hydraulic pump can be required. Generally, only a very limited installation space is available for the high-volume damper housing.

Summary of the Invention

An object of the present invention is to provide a hydraulic damper with a construction enabling connection to a hydraulic system even with limited installation space and having a relatively large volume of the damper housing.

According to the present invention, this object is attained by a hydraulic damper having a damper housing with a leading dimension defining the longitudinal axis of the housing, a connecting block for fluidic connection of the damper housing to the pertinent system, and a linking means assigned to the connecting block for mounting of the connecting block and the damper housing on the system in selectable rotary positions relative to the connecting axis, which axis extends transversely to the longitudinal axis of the housing.

Since the damper housing of the present invention may be connected to the pertinent hydraulic system in the desired rotary position, the damper housing can be housed in the pertinent installation space in different orientations. The orientations can be selected such that the leading dimension of the damper housing extends in the direction optimally using the space.

As a result, damper housings in an elongated construction mode and with a comparatively large volume can be accommodated in constricted machinery spaces. The possibility afforded by the present invention for selecting the rotary position of the damper housing around the connecting axis extending transversely to its longitudinal axis also enables direct connection, for example, at the output of the pertinent hydraulic pump. Even under constricted installation space conditions, for example, for hydraulic dampers of the reflection type in which a comparatively large volume of the damper housing is necessary, such damper can be directly connected to the pertinent hydraulic pump with the limited available installation space.

Preferably, the connecting axis to the leading dimension of the damper housing defining the longitudinal axis of the housing extends at least approximately vertically.

In one advantageous embodiment, the linking means has a pump connecting piece forming the fluidic connection between the connecting block and a hydraulic pump. Also, the connecting piece can be fixed at the output of the hydraulic pump in selectable rotary positions relative to the connecting axis.

If the output of the pump is provided for connection of linking parts according to the SAE standard, i.e., has a corresponding hole pattern for mounting screws, an annular body may be provided as the pump connecting piece of the linking means and attached to the output of the pump with a ring of holes located along the periphery of that annular body. These holes corresponding to the desired rotary positions of the connecting block relative to the connecting axis can be selected for the engagement of mounting screws provided on the connecting block. In these embodiments, a connection of the hydraulic damper to the output of the pump is possible in rotary steps corresponding to the spacing of the holes of the ring of holes in the pump connecting piece.

If, on the other hand, the pump connecting piece has a round end flange which in the selected rotary position can be fixed relative to the connecting axis by a half ring-like SAE flange, clamping jaws can be screwed to the SAE connecting parts of the output of the pump allowing continuous selection of rotary positions.

Other objects, advantages and salient features of the present invention will become apparent from the following detailed description, which, taken in conjunction with the annexed drawings, discloses preferred embodiments of the present invention.

Brief Description of the Drawings

Referring to the drawings which form a part of this disclosure:

FIG. 1 is a diagrammatic side elevational view of a hydraulic damper according to a first embodiment in the present invention;

FIG. 2 is an enlarged top plan view in section of the hydraulic damper of FIG. 1; and

FIG. 3 is a perspective view of the end area of a hydraulic damper connected to the output of a hydraulic pump by an SAE connection, drawn on a larger scale and also dismantled and exploded, according to a second embodiment of the present invention.

Detailed Description of the Invention

FIGS. 1 and 2 show a first embodiment of the present invention in the form of a reflection damper (silencer) having an elongated damper housing 1 with a leading dimension defining the longitudinal axis 3 of the housing. The damper housing 1 is fluidically connected or in fluid communication on its one end, located on the right in the figures, to the connecting block 5. In turn, connecting block 5 is connected by pump connecting piece 7 to the output of a hydraulic pump (not shown).

In its capacity as a hydraulic damper of the reflection type, i.e., as a resonator with an interference action, the accumulator housing 1 contains a damping pipe 9. Dampening pipe 9 extends coaxially to the longitudinal axis 3 between the entry end 11 and the exit end 13 of the damper housing 1. The damping pipe 9 in the area of its half length has slot openings 15 for coupling of the fluid oscillations in the damping pipe 9 to the fluid volume 17 surrounding it within the damper housing 1. The holes 19 constitute permanent ventilation of the space containing the volume 17 so that the hydraulic dampers need not be pre-charged for starting, because air accumulations are discharged by way of the holes 19.

On the entry end 11 and on the exit end 13, the damper housing has one inside thread 21 respectively. Screwed pieces 23 are screwed into threads 21. An inner hole of each screwed piece is concentric to the longitudinal axis 3, and holds the ends of the damping pipe 9. The O-rings 25 sitting in the inner holes of the screwed pieces 23 elastically support the damping pipe 9 so that the pipe 9 does not produce any rattling noise in operation, without narrow tolerances being necessary.

On the entry end 11 and on the exit end 13, one outside thread 27 is respectively provided on the damper housing 1. A connecting flange 29 is screwed onto the outside thread 27 on the exit end 13 to produce the connecting link to a consumer, for example, by an SAE connecting means on a pressure hose or the like. With the outside thread 27 on the entry end 11, the damper housing 1 is screwed to the connecting block 5. A threaded seal 31 is provided on the outside thread 27. The connecting block 5, with its inner chamber 33 fluidically connected to the damper housing 1, forms a preliminary chamber for the resonator system located in the damper housing 1. With its bottom-side opening 35 the chamber 33 of the connecting block 5 is fluidically connected through the pump connection 7 to the output of the hydraulic pump (not shown).

As is apparent from FIG. 2, the connecting block 5 has four holes 37 for engagement of mounting screws (not shown). With the mounting screws, the connecting block 5 can be screwed to the pump connecting piece 7. The pump connecting piece 7 is designed as an annular body in the embodiment from FIG. 1 and 2, and, for its part, can be linked to the output of the hydraulic pump. For interaction with the holes 37 on the connecting block 5, pump connecting piece 7 has a ring of holes 39 located on the same radius as the holes 37 of the connecting block 5 concentrically to a connecting axis 41 extending perpendicular to the longitudinal axis 3 of the housing. Connecting axis 41 is defined by the center of the opening 35 linking the chamber 33 to the hydraulic pump. The connecting block 5 can be turned around or rotated about the connecting axis 41 to produce alignment between the desired holes 39 of the ring of holes on the pump connecting piece 7 with the holes 37 on the connecting block 5. The damper housing 1 can then be aligned with its longitudinal axis 3 to the desired rotary positions, relative to the connecting axis 41. When the damper housing 1 is mounted on the pertinent hydraulic pump, the longitudinal extension of the damper housing 1 may be turned or rotated into a position in which the utilization of space is optimal under the respective installation conditions. Even under difficult installation conditions, a damper housing 1 with a comparatively large volume can be accommodated.

While in the embodiments shown in FIGS. 1 and 2 the rotary position of the damper housing 1 can be set in rotary steps corresponding to the spacing of the holes 39 on the periphery of the pump connecting piece 7 made as an annular body, the embodiment from FIG. 3 enables continuous setting of the rotary positions of the damper housing 1 around the connecting axis 41. For this purpose, in the second embodiment, the pump connecting piece 7 is not made as an annular body with a peripheral ring of holes. Rather, the pump connecting piece of the second embodiment is in the form of a circular cylindrical hollow body used as a fluid feed pipe. This fluid feed pipe produces the inner chamber 3 of the connecting block 5 connected with the output of the hydraulic pump. The hydraulic pump output is designated 43 and is illustrated schematically in FIG. 3. The hollow body of the pump connecting piece 7 is concentric to the

connecting axis 41 for the fluidic connection to the inner chamber 33 of the connecting block 5, and has a wall penetration or aperture 45 flush or coaxial with the longitudinal axis 3 of the damper housing 1.

On the open end projecting from the connecting block 5 and attachable to the pump output 43 for fluid entry, the pump connecting piece 7 has an end flange 47. By means of the half ring-shaped flange clamping jaws 49, as are common for connecting links according to the SAE standard (J 518), the pump connecting piece 7 can be fixed on the pump output 43. By turning the round end flange 47 of the pump connecting piece 7 within the clamping jaws 49 which annularly surround the end flange 47, the rotary position around the connecting axis 41 can be selected continuously, as desired.

Instead of the damper housing 1 being for a reflection damper, as shown for the two embodiments, damper systems with a different mode of operation could be equally mounted on the connecting block 5. For example, hydraulic dampers can be in the form of hydropneumatic bladder-type and diaphragm accumulators.

The hydraulic damper of the present invention can be provided as original equipment for a specific type of a plastic injection molding machine. Depending on space conditions on the respective machine, preferred holes on the pump connecting piece are provided over the existing hole pattern. With subsequent deliveries, a complex hole pattern on the pump connecting piece can then be dispensed with. A certain hole pattern can be selected in which the pertinent hydraulic damper assumes the desired position for the machine type provided for it on a plastic injection molding machine.

While various embodiments have been chosen to illustrate the invention, it will be understood by those skilled in the art that various changes and modifications can be made therein without departing from the scope of the invention as defined in the appended claims.